

- a. Provide a description of over-the-counter interest rate swaps ("OTC interest rate swaps") and cleared interest rate swap futures contracts;
- b. Provide a description of central clearing and explain how cash flows from variation margin affect the value of cleared interest rate swap futures relative to non-cleared OTC interest rate swaps;
- c. Provide a description of the Three Month Contract, the interest rate swap futures contract at issue in this matter;
- d. Provide a valuation of the Three Month Contract and opine on the analysis and findings presented by Cont *et al.* (2011);<sup>6</sup>
- e. Provide a description and analysis of DRW's bids on the Three Month Contract;
- f. Provide an explanation of price discovery in the context of the current matter;
- g. Opine on CFTC's allegations of market manipulation and illicit profits; and
- h. Review and respond to certain aspects of the MacLaverty Report.

## II. SUMMARY OF OPINIONS

4. Based on my review of available information, I have reached the following opinions and conclusions:

- a. The rates that represent fair value on the cleared Three Month Contract are higher than rates on non-cleared OTC interest rate swaps with similar terms due to cash flows from daily variation margins applied on the cleared Three Month Contract. These higher rates stem from interest rate volatility and an upward sloping yield curve over the term of the swap.
- b. The difference in value between a cleared instrument such as the Three Month Contract and a non-cleared instrument such as an OTC interest rate swap with similar terms is commonly referred to as the net present value ("NPV") effect and/or the convexity effect,<sup>7</sup> which are widely accepted features of centrally cleared interest rate derivatives.

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<sup>6</sup> Cont, Rama, Mondescu, Radu, and Yu, Yuhua, "Central Clearing of Interest Rate Swaps: a Comparison of Offerings," March 11, 2011. Available at <http://ssrn.com/abstract=1783798> (hereinafter "Cont *et al.* (2011)").

<sup>7</sup> Also known as "convexity bias." See Pozdnyakov, Vladimir, and Steele, J. Michael. "Convexity Bias in Eurodollar Futures Prices: A Dimension-Free HJM Criterion." *Methodology and Computing in Applied Probability* 11, no. 4 (2009): 551-560; Gupta, Anurag, and Subrahmanyam, Marti G. "An empirical examination of the convexity bias in the pricing of interest rate swaps." *Journal of Financial Economics* 55.2 (2000): 239-279.

- c. DRW's bids on the Three Month Contract *are consistent with my calculations of the NPV effect and the convexity effect using the Hull-White One-Factor model of expected interest rate dynamics applied on data from January through August 2011 (the "Relevant Period"). Based on this analysis, DRW bid at reasonable prices which represented legitimate demand for the long side of the Three Month Contract and not "artificial prices," as alleged.*
- d. Because DRW's bids on the Three Month Contract reflected the NPV and convexity effects, they *represent a clear example of legitimate price discovery in the Three Month Contract.*
- e. DRW's bids on the Three Month Contract offered premium rates relative to the non-cleared OTC interest rate swap with similar terms and therefore *were more representative of true supply or demand for the Three Month Contract than were non-cleared prices on OTC interest rate swaps. In other words, prices of non-cleared OTC interest rate swaps did not reflect legitimate supply or demand for the Three Month Contract, but DRW's bids did.*
- f. DRW's electronic bids on the Three Month Contract *represented true interest to buy at the posted prices and quantities throughout the trading day because: (a) they were posted for almost 47 minutes, on average, and thereby, exposed DRW to the risk of one of its posted bids being hit and (b) they were posted at rates within the range of (or consistently below) all estimates of fair value.*
- g. Contrary to the CFTC's assertion that DRW's bids active during the Three Month Contract's settlement period (1:45PM to 2:00PM CT, "Settlement Period"), were withdrawn "shortly thereafter," I find that *DRW's bids active during the Settlement Period were posted for more than 17 minutes, on average—longer than the 15-minute Settlement Period itself—and exposed DRW's trading interest broadly to the market.*
- h. DRW's profits did not depend on DRW's bids in the electronic market, as the CFTC alleges, but rather stemmed from interest rate movements and the fact that *DRW entered into a long position in the Three Month Contract at below fair value. Whether or not DRW or another party posted bids at a premium after taking a position in the Three Month Contract (which more closely reflected supply or demand for the Three Month Contract), DRW would have realized substantially the same stream of cash flows generated by the exchange of variation margin over time.*
- i. The shift from International Derivatives Clearinghouse ("IDCH")<sup>8</sup> using OTC interest rate swap prices to more appropriate cleared Three Month Contract-specific prices was inevitable. *Given the real economic differences between an OTC*

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<sup>8</sup> IDCH is a wholly-owned subsidiary of the International Derivatives Clearing Group ("IDCG").

See Complaint ¶24.

*interest rate swap and the Three Month Contract, a rate premium was appropriate for the Three Month Contract.*

5. My detailed findings, opinions, and conclusions follow in this report and its appendices and exhibits. **Section III** provides a summary of my qualifications and the compensation I receive for my work on this matter. **Section IV** presents the types of documentation and materials I relied on in preparing this report. **Section V** provides background information on the current litigation. **Section VI** describes the characteristics and trading of OTC interest rate swaps and interest rate swap futures contracts. **Section VII** analyzes the Three Month Contract and how it differs from an OTC interest rate swap. **Section VIII** presents valuation analyses of the Three Month Contract and estimations of the NPV and convexity effects under the Hull-White One-Factor model. **Section IX** describes DRW's bids on the Three Month Contract. **Section X** explores price discovery as it relates to the current matter and explains that DRW's bids were important for price discovery. **Section XI** summarizes why there is no basis for claims of market manipulation or illicit profit. **Section XII** reviews and comments on the MacLavery Report. Last, **Section XIII** concludes.

### III. QUALIFICATIONS AND COMPENSATION

#### A. Summary of Qualifications

6. I, Jeffrey H. Harris, am the holder of both the Gary Cohn Goldman Sachs Chair in Finance and the Finance and Real Estate Department Chair at the American University in Washington, D.C. From 2011 to 2013, I served as the Dean's Chair in Finance at Syracuse University. Between 1995 and 2011, I was a professor, an assistant professor or a visiting assistant professor at The Ohio State University, the University of Notre Dame, Southern Methodist University, and the University of Delaware. During that period,



from 2006 to 2010, I also served as a consultant and as Chief Economist of the CFTC. Earlier, in 1999-2000, I was a visiting academic scholar at the U.S. Securities and Exchange Commission ("SEC") and, in 2000-2001, a visiting academic fellow at the NASDAQ Department of Economic Research.

7. My areas of research include finance, market microstructure, and regulatory issues. Over the course of my academic career, I have published scholarly articles in various journals including *Journal of Finance*, *Journal of Futures Markets*, *Journal of Financial Economics*, *Journal of Financial and Quantitative Analysis*, *Journal of Investment Management*, and *Review of Financial Studies*, among others. I have co-written chapters in finance books such as "Equity Market Derivatives" in *Financial Derivatives: Pricing and Risk Management* (2009).<sup>9</sup> I have taught courses in options, futures, and other derivatives, empirical finance, and speculative markets at the undergraduate, master's, and doctoral levels.
8. I am currently serving as a director at the Eris Exchange. I have been a member of the Board of Directors for the Southern Finance Association and currently serve on the program committee for the European Finance Association and the Western Finance Association. I serve on the Editorial Advisory Board for the *Journal of Risk Finance* and actively referee papers for several finance and economics journals. I have also consulted with various organizations on finance-related issues and have provided testimony before the CFTC and U.S. Congress on numerous matters involving pricing and financial speculation.

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<sup>9</sup> Kolb, Robert W., and Overdahl, James A. *Financial Derivatives: Pricing and Risk Management*, Robert W. Kolb Series in Finance, John Wiley and Sons, Inc., 2009.

9. My *curriculum vitae*, which provides details of my qualifications, publications, and other professional activities, including a list of matters in which I have testified, is attached as **Appendix A**.

**B. Compensation**

10. I am being compensated for my time and services in this matter at the hourly rate of \$750. Certain employees of Analysis Group have provided support and assistance in preparing this report. My compensation is not contingent on the opinions that I express or the outcome of this litigation.

**IV. DOCUMENTS AND MATERIALS CONSIDERED**

11. In preparing this report, I have drawn on my education, knowledge, and experience in finance and derivatives developed over many years. I have also relied upon documents and other materials produced in this litigation as well as various industry publications and other publicly available material. Examples of the types of information I have considered in this report include the following:
- a. Legal pleadings and associated exhibits filed in connection with the current matter;
  - b. Plaintiff's legal submissions and the expert report of Mr. Robert M. MacLavery;
  - c. Various deposition transcripts and associated exhibits including those by Mr. Donald R. Wilson, Jr., Mr. Brian Vander Luitgaren, and Mr. Craig Silberberg;
  - d. Various documentary evidence related to the Three Month Contract produced in this matter; and

- e. Legal pleadings and associated exhibits filed in connection with the arbitration matter *Jefferies & Company, Inc. v. The NASDAQ OMX Group, Inc., International Derivatives Clearing Group, LLC, and International Derivatives Clearinghouse, LLC*.
12. A list of documents and materials considered in the preparation of this report is set forth in **Appendix B**. As my work on this matter is ongoing, I may review additional materials produced subsequent to the issuance of this report and/or conduct further analysis. Accordingly, I reserve the right to update, refine or revise my opinions, or form additional opinions. I also reserve the right to respond to any expert opinions put forward by the CFTC in response to the opinions presented in my report.

#### **V. BACKGROUND OF THE LITIGATION**

13. The CFTC alleges that defendants DRW and Donald R. Wilson, Jr. “manipulated and attempted to manipulate the daily settlement rates” of the Three Month Contract by illegally placing orders to move prices in their favor during the Relevant Period.<sup>10</sup>
14. As alleged in the Complaint, the Three Month Contract was cleared by IDCH and traded on the NASDAQ OMX Futures Exchange (“NFX”).<sup>11</sup> The Three Month Contract could be traded in two different ways: a) a voice broker could bring two parties together to enter a bilateral transaction and then submit the transaction to IDCH for clearing on the exchange (*i.e.*, an Exchange of Futures for Swaps transaction);<sup>12</sup> or b) parties could directly post executable electronic bids and offers on the exchange via a third party as allowed by IDCH and NFX. All of DRW’s long positions in 2010 were established

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<sup>10</sup> Complaint ¶1 and ¶5.

<sup>11</sup> Complaint ¶2.

<sup>12</sup> IDCG Marketing Presentation, pp. 6-7, D0163512-13.

through the first method via the voice broker NewEdge USA, LLC.<sup>13</sup> Around August 2010, DRW had acquired a long position in the Three Month Contract for a notional principal of over \$350 million.<sup>14</sup>

15. The value of DRW's long position was marked to market every day (*i.e.*, gains and losses were accounted for at the end of each trading day) based on the daily settlement rates of the Three Month Contract for various maturities. Each day, IDCH determined these daily settlement rates, which collectively made the "IDEX Curve," using its proprietary methodology that incorporated, among other things, exchange activity on the NFX – including bids and offers made by market participants during the Settlement Period.<sup>15</sup> In the absence of exchange activity, IDCH set its daily settlement rates to be the "prevailing interest rates in corresponding bilateral interest markets," which the Complaint defines as "Corresponding Rates."<sup>16</sup>
16. After DRW had acquired its long position, it came to recognize that IDCH did not settle the Three Month Contract at prices reflective of market activity in the voice broker market in which DRW had continued to participate.<sup>17</sup> DRW informed IDCH accordingly and, at the suggestion of IDCH, began placing electronic bids shortly thereafter. DRW's electronic bids were made through a platform developed by Sky Road LLC, a company, which, I understand, was recommended to DRW by IDCH for that very purpose.<sup>18</sup> DRW

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<sup>13</sup> Complaint ¶41.

<sup>14</sup> Complaint ¶3.

<sup>15</sup> Complaint ¶3.

<sup>16</sup> Complaint ¶3.

<sup>17</sup> See DRW Letter to IDCG, Investigation Number IDCH II 2011-1, February 18, 2011.

<sup>18</sup> See Deposition of Donald R. Wilson, Jr., April 2, 2013, p. 18, p. 66, and p. 89; Email from IDCG to DRW, December 20, 2010, D0165286.



placed bids expressed in terms of a fixed interest rate, which, if accepted, were to be paid to the party with the short position on a semi-annual basis throughout the duration of the contract. The Complaint alleges that DRW placed bids primarily during the Settlement Period at interest rates higher than the Corresponding Rates that would otherwise prevail and withdrew these bids shortly afterwards to influence daily settlement rates in its favor.<sup>19</sup> Over an 8-month period, DRW's bids allegedly caused IDCH to settle the Three Month Contract at rates increasingly higher than the Corresponding Rates. Using such mechanism, according to the CFTC, DRW allegedly improved the value of its open positions in the Three Month Contract. According to the CFTC, DRW's bids caused artificial prices on the Three Month Contract on at least 118 trading days affecting multiple maturities from seven to 30 years of over 1,000 contracts.<sup>20</sup>

**VI. OVERVIEW OF OTC INTEREST RATE SWAPS, INTEREST RATE SWAP FUTURES CONTRACTS, AND CENTRAL CLEARING**

**A. OTC Interest Rate Swaps**

17. A swap is a derivative contract between two parties exchanging a series of cash flows at predetermined future dates. In an over-the-counter ("OTC" or off-exchange) interest rate swap, two parties reach an agreement to exchange periodic interest payments based on a

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<sup>19</sup> Complaint ¶5.

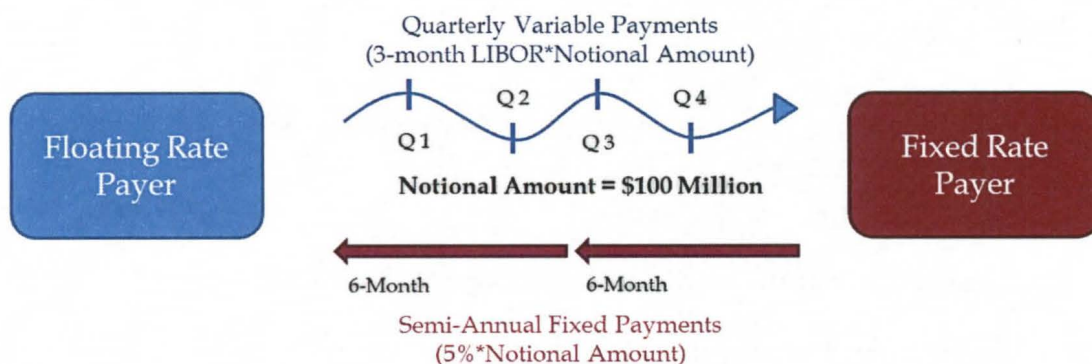
<sup>20</sup> Complaint ¶6 and ¶49.



predetermined notional amount.<sup>21</sup> In simplified terms, each party pays a dollar amount calculated as the product of the agreed-upon interest rate and the notional amount.<sup>22</sup>

18. In the simplest form of an OTC interest rate swap, one party known as the *fixed rate payer* makes fixed and periodic interest payments throughout the duration of the contract. The other party called the *floating rate payer* makes interest payments fluctuating in response to changes in a benchmark rate. Various money market rates can be used for determining the floating rate with the most common benchmark being the London Interbank Offered Rate ("LIBOR").<sup>23</sup> As the most prevalent structure of a swap, a fixed-for-floating OTC interest rate swap is often called a "plain vanilla" interest rate swap. Figure 1 below illustrates an example of an interest rate swap.

**Figure 1: Illustration of an OTC Interest Rate Swap**



19. In the above illustration, the fixed rate payer agrees to pay a 5% fixed rate of the notional amount of \$100 million on a semi-annual basis for a given contract maturity. In return,

<sup>21</sup> Fabozzi, Frank J., and Mann, Steven V., *The Handbook of Fixed Income Securities*, Eighth Edition, McGraw Hill Professional, 2012, pp. 1445-46 (hereinafter "Fabozzi et al. (2012)").

<sup>22</sup> The notional amount represents the scale of the trade for the purpose of this calculation; it does not actually represent an amount transferred from one party to another.

<sup>23</sup> The LIBOR is the benchmark interest rate that major banks charge to lend funds to one another for a given maturity (e.g., 1-month LIBOR, 3-month LIBOR, or 6-month LIBOR).

the floating rate payer agrees to pay the 3-month LIBOR of the notional amount of \$100 million on a quarterly basis for the same contract maturity. As an interest rate derivative, the value of the interest rate swap changes relative to movements in interest rates, with the floating rate payer benefiting when interest rates (*i.e.*, LIBOR) decrease, and the fixed rate payer benefiting when interest rates increase.

#### **B. Interest Rate Swap Futures Contracts**

20. In a *futures contract*, a buyer (seller) agrees to receive (make) delivery of a valued item such as a commodity or financial securities at an agreed-upon price and date.<sup>24</sup> An interest rate swap futures contract is a futures contract based on the exchange of cash flows established by an underlying interest rate swap. The buyer of the futures contract is the fixed rate payer and is said to be *long the futures* and the seller of the futures contract is the floating rate payer and is said to be *short the futures*. As for an OTC interest rate swap, the value of the interest rate swap futures changes relative to movements in interest rates. For the fixed rate payer (floating rate receiver), the value of the interest rate swap futures increases when interest rates increase.<sup>25</sup> The floating rate payer (fixed rate receiver) benefits from declining interest rates.

#### **C. Central Clearing of Interest Rate Swap Futures Contracts**

21. While the payment terms, notional amount, and interest rates of the swap underlying the interest rate futures contract are identical to those of an OTC interest rate swap, the trading and cash flows of both instruments differ substantially.

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<sup>24</sup> Fabozzi *et al.* (2012), p. 1370.

<sup>25</sup> Fabozzi *et al.* (2012), pp. 1464.